3.6. CULTURAL AND HISTORIC RESOURCES

The Salmon-Challis National Forest, parts of which contain project areas, is in the process of being surveyed for cultural and historic resources. The East Fork Salmon River and West Fork Yankee Fork Salmon River likely contain prehistoric camps and fishing sites, as well as historic mining sites.

Traditional prehistoric fishing sites are known to exist along the Bear Valley Creek tributary to the Lemhi River, with prehistoric campsites on the terraces above the river. Historic USFS trails follow the creek along each bank (Steve Matz, archeologist, USFS, Salmon-Challis National Forest, personal communication, May 31, 2000).

4. ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

This chapter discusses the potential impacts to affected environments from the alternatives. Sections of the chapter are organized by affected environments, i.e., ESA-listed Anadromous Fish; Floodplains and Wetlands; Water Quantity and Quality; Visual Quality; and Cultural Resources. The chapter also describes impacts from the No Action Alternative, and cumulative impacts from the alternatives.

4.1. SUMMARY OF POTENTIAL IMPACTS FROM THE ALTERNATIVES

Table 3: Summary Table - Comparison of Potential Impacts

Resource	Existing Conditions	Impacts of Proposed Action	Impacts of Alternative One: Parr Collection	Impacts of Alternative Two: Big Springs Creek Adult Release	Impacts of No Action Alternative
Anadromous Fish 1. Spring/summer chinook salmon 2. Summer steelhead 3. Bull Trout	1. Listed. High-priority local populations in project areas. 2. Listed. Present in project areas. 3. Listed. Present in project areas.	1. IDFG Program activities would remove broodstock from local populations. If the IDFG Program works, it will return more sexually mature adults than it removes, having a net positive impact on at-risk populations. If the IDFG Program does not work, it could hasten extirpation.	1. Overall, this alternative would have a net positive impact, should the IDFG Program work *(see previous column)*. If not, could hasten extirpation of target populations. This alternative may impair overall effectiveness of	Same as the Proposed Action for all anadromous species.	1. No action would most likely result -in– although not cause– extirpation of target spring/summer chinook salmon local populations. 2. No impacts. 3. No impacts.

Resource	Existing Conditions	Impacts of Proposed Action	Impacts of Alternative One: Parr Collection	Impacts of Alternative Two: Big Springs Creek Adult Release	Impacts of No Action Alternative
		Assuming the IDFG Program works, increased outplanted adults would likely improve genetic variability. Low numbers of hatchbox releases are not likely to create any density-dependent impacts (competition, predation, etc.) on natural juveniles, since stream carrying capacities are underutilized. Domestication effects are likely to have slight to nonexistent impacts on genetic variability/fitness of naturally rearing cohort. 2. Possibility of temporary, short-term impacts from collection activities. 3. Possibility of temporary, short-term impacts from collection activities.	the IDFG Program, should broodstock collected as parr survive at lower rates than those collected as eyed eggs (due to disease), or should age-to-size anomalies of collected parr broodstock impede their ability to compete for mates. 2. Same as Proposed Action. 3. Same as Proposed Action.		

Table 3 continued

Resource	Existing Conditions	Impacts of Proposed Action	Impacts of Alternative One: Parr Collection	Impacts of Alternative Two: Big Springs Creek Adult Release	Impacts of No Action Alternative
Floodplains and Wetlands	Seasonal wetlands within project areas.	All access is via road or developed trails. No ground disturbances and/or erection of structures. No significant impacts are expected. Placement of streamside hatchboxes may have temporary (Nov. through Apr.), short-term impacts to streamside vegetation.	Same as the Proposed Action.	Same as the Proposed Action.	The No Action Alternative would have no impact one way or the other on floodplains and wetlands.
Water	Water quality is generally pristine in the project areas. Quantity is determined by streamflow, and is sufficient to IDFG Program needs.	Temporary, short-term turbidity from eyed-egg collection, placement of hatchboxes, and erection of enclosures. There would be no consumptive use of water, or water withdrawal. No significant impacts to water quantity.	Same as the Proposed Action.	Same as the Proposed Action.	The No Action Alternative would avoid the temporary short-term impacts to water quality from the alternatives.

Resource	Existing Conditions	Impacts of Proposed Action	Impacts of Alternative One: Parr Collection	Impacts of Alternative Two: Big Springs Creek Adult Release	Impacts of No Action Alternative
Visual Quality	Farmland on private lands. Public lands are undeveloped floodplains, transitioning to foothills and mountains.	Streamside egg boxes are temporary during low traffic months (Nov. through Apr.). Enclosures are temporary and non-intrusive. No expected significant impacts.	Operation of screw traps and weirs would be short term and temporary. No significant impacts to visual quality.	Same as the Proposed Action.	The No Action Alternative would avoid the temporary short-term impacts to visual quality from the alternatives.
Cultural and Historic Resources	Likely prehistoric and historic resources within project areas. Salmon are an important cultural resource for tribes.	All access is via road and/or developed trail. No ground disturbances and/or erection of structures. No impacts are expected to cultural resources. Recovery of salmon would restore an important cultural resource to the tribes.	Same as the Proposed Action.	Same as the Proposed Action.	Rather widespread cultural resources are thought to exist within the project areas. The No Action Alternative would avoid impacts to these cultural resources that might occur, should IDFG Program activities inadvertently disturb them. If the No Action Alternative leads to extirpation, ceremonial and spiritual use of salmon by the tribes would be negatively impacted.

4.2. IMPACTS FROM THE PROPOSED ACTION

4.2.1. Direct Impacts to Anadromous Salmonids

4.2.1.1 Broodstock (Eyed-Egg) Collection

Impacts to Migrating Juveniles and Adults: IDFG Program managers do not expect long-term impacts to any listed anadromous species from eyed-egg collections. Wading, snorkeling, and collection activities would take no longer than 3 days per target stream (usually less). Later-returning spring/summer chinook salmon could potentially encounter collection activities. Effects from the activity could induce confusion and stress that might lead to delayed and/or unsuccessful spawning. However, managers assume that later-returning chinook salmon spawn below the areas of earlier-returning fish and would not be affected. In any case, activities are limited and short term, and would be temporarily postponed in the presence of returning adults.

Steelhead young of the year rear at higher elevations during collection, and no impacts are expected. Migrating pre-smolts would not be significantly impacted by short-term, low-impact collection activities.

Approximately 600 meters (1,800 feet) elevation gradient separates bull trout spawning areas from spring/summer chinook spawning areas. Adult bull trout would likely be spawning above egg-collection sites at the time of collection. Fry do not emerge typically until December, well after collection activities. Rearing bull trout usually spend from 1 to 4 years at higher elevations before emigrating for final rearing; thus, rearing bull trout migrating through project areas would likely be developed enough to withstand temporary turbidity during collection. No impacts are expected.

Direct Impacts to Spring/Summer Eggs/Juveniles: Should collection create short-term (within the incubation period) mortalities to the eggs themselves, it would represent a reduction in potential natural escapement. Uncertainty surrounds potential impacts to eggs from collection and transport. Uncertainty also surrounds potential impacts from these activities to eggs left behind in the redds. Loss of hatchery or **natural production** potential due to egg loss, however, would likely be offset by increased hatchery egg-to-adult survival (IDFG 1999, 2000).

While IDFG Program managers are uncertain as to the magnitude of direct mortality to collected and uncollected eggs from snorkeling, wading, and venturi effects, eggs are highly resistant to mortality at the eyed stage. Hatcheries routinely shock, sort, count, and transport eggs without inducing high mortalities. Eyed eggs are much easier to transport than juveniles, and transportation of eyed eggs is a commonly accepted hatchery practice. IDFG Program managers expect only slight impacts to collected and uncollected eggs. However, managers recognize the need for further study, which is an objective of IDFG Program monitoring and evaluation.

4.2.1.2 Rearing

Domestication Effects: Artificial-rearing protocols and procedures may create characteristics in hatchery fish that are different from those in natural fish, such as

different coloring, size-to-age ratios, etc. The name that has been given to these characteristics is **domestication effects**. Exactly how and to what extent domestication effects impact the fishes' suitability for life in the wild is uncertain.

Theorized domestication effects are too numerous to list. A few examples might be: hatchery fish are automatically fed, and may be less suited to seeking out food in the wild; hatchery fish are reared in high densities, and may have age-to-size ratios that differ from their wild cohort; hatchery fish may differ in coloration and/or shape from wild fish because of dietary regimes; and fish reared in protected environments may be unsuccessful recognizing and avoiding predators.

While the domestication effects are incompletely understood, the policy of NMFS (1999) and the Council (2000) is that fish produced by artificial rearing should morphologically, physiologically, and behaviorally resemble naturally rearing fish to the extent possible. This has led to a number of experimental artificial rearing protocols to produce such fish. Like domestication effects themselves, these protocols are too numerous to list.

The IDFG Program expects impacts to broodstock from domestication effects, to the extent that they exist and are understood. IDFG Program monitoring and evaluation data has already led to adapted protocols, including introducing feeding regimens that produce more natural coloration, and rearing a higher percentage of broodstock in saltwater to improve fin quality. The IDFG Program monitors and evaluates hatchery broodstock for domestication effects, and would continue to adapt IDFG Program protocols as effects become apparent.

The duration of hatchery rearing may multiply the impacts of domestication, although the relation of duration is poorly understood. While clearly some effects are mitigated by shortened hatchery rearing, other effects seem duration-neutral. In the case of age-to-size ratios, ratios seem to improve in broodstock raised from eyed eggs rather than parr, because hatchlings tend to begin feeding immediately, while collected parr do not.

Preliminary IDFG Program data (IDFG 1999, 2000) indicate that outplanted adults are building and defending redds and otherwise exhibiting behaviors adapted to the wild, thus fulfilling production objectives.

Disease: Both hatcheries and streams contain disease-causing **pathogens**. High rearing densities associated with artificial rearing promote contagion (spread) of these pathogens. At the same time, hatchery fish stressed by rearing protocols may be more prone to infection.

Mostly, this is considered to be a problem when infected hatchery releases transmit pathogens into the natural environment. IDFG Program broodstock, on the other hand, are collected from the natural environments and bring pathogens into the hatchery environment. Disease brought into the hatchery by IDFG Program parr has reduced IDFG Program effectiveness (IDFG 1999, 2000*).* IDFG Program managers hypothesize that rearing broodstock from eyed eggs rather than parr will reduce these impacts.

Since all IDFG Program broodstock are required to be disease-free, there should be little or no disease transmission impacts back to natural habitats. In any case, little

evidence suggests that diseases are routinely transmitted from hatchery to natural fish (Steward and Bjornn 1990).

Chapman et al (1994) concluded that disease transmission from hatchery to wild populations is probably not a major factor negatively affecting wild steelhead in the Columbia River Basin. The same is assumed to be true for bull trout. No impacts from disease transmission to natural anadromous salmonids are expected.

4.2.1.3 Adult Enclosures

The IDFG Program would construct temporary, short-term enclosures in early August to prevent IDFG Program adults from straying outside their stream of origin. These would remain in place throughout the spawning season (end of September). IDFG Program managers expect no impacts to listed anadromous species from the construction or operation of enclosures. At the time of construction, vulnerable young-of-the-year steelhead and/or bull trout inhabit higher elevations. Returning adult spring/summer chinook salmon, and rearing steelhead and/or bull trout juveniles encountering construction may become slightly confused for the short term.

All enclosures are manned daily by IDFG Program personnel, and checked frequently. Any fish inadvertently caught in weirs or traps (Bear Valley Creek) would be removed and released.

4.2.2. Indirect Impacts to Anadromous Salmonids

Some actual and/or theorized effects from artificial rearing relate to the impacts to natural population from interactions with hatchery releases.

4.2.2.1 Delayed Impacts from Eyed-Egg Collection

The stress of collection on collected eggs and eggs left in the redds could indirectly affect long-term survival of individual fish. IDFG Program managers are unaware of any studies analyzing long-term indirect impacts of eyed-egg collections to spring/summer chinook salmon. Developing such information is an IDFG Program monitoring and evaluation objective.

4.2.2.2 Predation

Released hatchery adults are not in a feeding mode, and should not pose a threat to any anadromous species.

The small size of the release is not expected to draw more large predators. However, this is a continued area of study. If true, as theory has it, that hatchery rearing reduces predator recognition and avoidance, then the hatchery fish would be at increased risk to predators. To date, IDFG Program personnel have observed spawned-out carcasses bearing evidence of predation, although this may have occurred post-mortem.

Increased natural and/or hatchbox juvenile outmigration sometimes produces increased **inter-specific** and **intra-specific** predation. Ultimately, the trend toward increased predation of any kind is density-dependent. All project streams are **underseeded**, however, and natural production gains would not change that in the short

term. Hatchbox juveniles volitionally release, and so would not present a mass to predatory birds, fish, pinnipeds, etc.

Larger spring/summer chinook salmon smolts may eat smaller fish, but recent information indicates that fish are an insignificant fraction of the food consumed by migrating chinook salmon in the Snake and Columbia Rivers (Muir and Coley 1995). The Species Interaction Work Group (SIWG 1984) reported that there is an unknown risk of predation by artificially reared chinook on wild steelhead juveniles where they interact in freshwater migrational areas.

4.2.2.3 Competition

Released hatchery adults are expected to compete with their natural cohort by defending redds and competing for mates. This is normal and desirable behavior since, presumably, the best-adapted fish should attract mates. No other types of competition (for food) are expected, since pre-spawn adults are not in a feeding mode. The same is true for competition with listed steelhead and bull trout.

Large numbers of artificially reared fish are known to disrupt spawning behaviors in naturally reared fish. However, IDFG Program hatchery release sizes are indexed to forecasted numbers of returning adults, and would be reduced (to zero, if necessary) if few returning adults were forecasted. While this is not expected to be a problem, such impacts are under IDFG Program study.

Increased natural production and/or hatchbox juvenile outmigration: Increased natural production from IDFG Program measures should not increase competition with existing anadromous populations, since such increased production would be small in the short term. Competition correlates to the **carrying capacity** of the streams, which are severely underseeded.

Once outplanted eyed eggs hatch and swim up as fry, direct competition for food and space may occur. Impacts from competition are assumed to be greatest in the spawning and nursery areas and at the points of highest density (release areas), and to diminish as hatchery smolts disperse (USFWS 1994). Competition continues to occur at some unknown—but probably lower—level as smolts move downstream through the migration corridor. Again, however, since the carrying capacity of all target streams is severely underutilized, impacts to existing anadromous species are expected to be minimal.

Juvenile salmon have been shown to behaviorally dominate juvenile steelhead. However, where inter-specific populations have evolved **sympatrically**, chinook and steelhead have evolved slight differences in habitat use patterns that minimize their interactions. Segregation of species appears to be both actively maintained and adaptive (Nilsson 1967). Juvenile spring/summer chinook salmon and bull trout are separated by elevation, and would not compete.

4.2.2.4 Genetic Diversity/Variability and Fitness

IDFG Program broodstock share the genetic make-up of the receiving population, since they were collected in the wild from that population. Therefore, the introduction of

non-native **alleles** into the receiving population (introgression) would not factor into genetic diversity/variability and fitness. Nor would be the loss of unique alleles factor in, since the higher rate of hatchery egg-to-adult survival would presumably preserve a higher percentage of these unique alleles.

Domestication Selection Effects: Some individual genetic make-ups are theorized to produce traits in fish favored by the hatchery ("domestic") environment. For example, perhaps a combination of alleles determines or contributes to an age-to-size ratio that is small for a natural fish of the same age. This smaller hatchery fish might thrive within the higher rearing densities of the hatchery. This tendency of the hatchery environment to favor the survival of fish with beneficial **phenotypes** is called "domestication selection."

When (and if) these genotypic/phenotypic types survive in higher proportion to others because they are better adapted to the hatchery, this is "disproportionate survival" (of their genotype, relative to other genotypes in their population). When released—since they have survived disproportionately—they stand a better chance of passing their heritage on to the rest of the population. Future generations, being smaller, may then be less fit to compete at all life stages, leading to a depression in the population.

Whatever the extent that these theories prove true, IDFG Program managers assume that the hatchery environment, like all environments, selects for phenotypes/genotypes suited to survival within it. However, since approximately 80 percent of broodstock survive to outplanting—even if true that certain alleles produce domestic traits that are selected for—these genotypes would not likely be over-represented.

Inbreeding and outbreeding depression: The term "inbreeding" refers to breeding among members of a local **breeding unit**. The term "outbreeding" refers to breeding among members of different breeding units. Either of these conditions can be beneficial or deleterious to a population. In large and healthy populations, inbreeding sustains the unique genetic heritage of the population without necessarily compromising genetic diversity/variability; outbreeding increases genetic diversity/variability without compromising the unique heritage.

In declining populations, however, inbreeding can cause "depressions" (long-term reduction of population). Inbreeding can efficiently pass destructive genes or gene complexes within the small number of breeders. Outbreeding, meanwhile, may introduce destructive genes into a population too small for adaptive pressures to select them out over time. Impacts from inbreeding and outbreeding are dependent on population size, which in turn functions to modify duration and intensity of the introgression.

The objective is to increase the size of the spawning population, thus widening the gene pool. Therefore, inbreeding risks should be reduced by IDFG Program measures.

The major cause of outbreeding is straying: returning pre-spawn adults from one distinct breeding unit straying into the territory of another. Managers of the IDFG Program expect no impacts from outbreeding. While they have observed "wandering" among hatchery fish (wandering within their stream system where they encounter

genetically similar receiving individuals), only one fish has been observed to "stray" outside its own watershed (IDFG 1999, 2000).

Hatchbox offspring: Hatchery spawning has the highest potential to produce a genetically divergent hatchery population, if spawning protocols are inadequate. The IDFG Program follows IHOT (1995) spawning protocols *(see Section 2.3).* Collection of eyed eggs for use as broodstock should give managers enhanced control over gender ratios and family representation of broodstock, which would add to the effectiveness of the dissimilarity matrix when breeding surplus fish in-hatchery. Impacts are expected to genetic fitness/variability from in-hatchery spawning and outplanting in the same measure as from any prudently managed supplementation program.

4.2.3. Floodplains and Wetlands

Work crews would be passing on developed trails through floodplains and seasonal wetlands for egg collection, erection of in-stream enclosures, placement of egg boxes, and monitoring activities. No ground-disturbing activities would take place. No permanent structures would be erected on any floodplain or wetland. No impacts are expected to floodplains or wetlands from these activities.

Streamside units containing Whitlock-Vibert hatchboxes are heavy and large (commercially available freezers) and would impact early-emerging vegetation in relation to the size of the units. However, no more than one or two would be placed streamside. These units would be temporary, until swim up and volitional release of pre-smolts (June through February). Flooding is unusual during periods of operation. Impacts to small areas of early-emerging vegetation would be slight. No impacts are expected to floodplains.

4.2.4. Water Quality/Quantity

There would be no consumptive use of water or water withdrawal from project streams during egg collection, placement of enclosures for adult outplants, placement and/or operation of instream egg boxes, and/or monitoring and evaluation. Thus, there would be no impacts to water quantity.

All these activities, however, are likely to lead to short-term increased turbidity. No significant changes to water quality are expected from adult and/or hatchbox outplants, due to small size of the releases and the underutilized stream-carrying capacities. Positive impacts to the nutrient loads could be expected from spawned-out carcasses.

4.2.5. Visual Quality

Egg collection and adult release (construction and/or operation) would affect visual quality at all sites. These effects would be short term, temporary, and minor. Visual quality on private lands is already affected by land-use practices, such as agriculture and grazing, and would not be greatly compromised. Nor would activities and/or enclosures violate visual quality objectives on USFS-owned land (USFS objectives for affected areas are for "partial retention" of foreground areas).

4.2.6. Cultural and Historic Resources

Historic and prehistoric cultural resources are known to exist in project areas, although not all sites have been surveyed. No ground-disturbing activities would take place. No permanent structures would be erected. Therefore, no impacts are expected. Should any historic or prehistoric resources be observed, work would stop immediately and the Idaho State Historic Preservation Office would be contacted, as well as local tribal cultural resources officers.

4.3. IMPACTS OF THE ALTERNATIVES

Below, potential impacts from the Parr Collection Alternative, the Alternative Adult Release Site, and the No Action Alternative are presented. Cumulative effects are also discussed.

Other than for the activities specified below, action alternatives are identical with the Proposed Action. Thus, effects for such measures as hatchery spawning and eyed-egg outplanting can be found in the analysis of the Proposed Action.

4.3.1. Parr Collection Alternative

4.3.1.1 Anadromous Salmonids

The IDFG Program has used broodstock reared from parr since its inception in 1995. In terms of meeting the broad objective of increasing natural spawning opportunities, parr have succeeded. However, IDFG Program monitoring and evaluation indicates that hatchery parr may not survive at the rate of broodstock collected as eyed eggs. Particularly problematic is disease transmission among hatchery parr. Thus, while meeting objectives, parr are not thought to meet them as efficiently as eyed eggs. Therefore, IDFG Program managers believe that the Parr Collection Alternative is reasonable, but not preferable to the Proposed Action.

Direct Effects – Erection and Operation of Weirs and Traps: Erection and operation of weirs and traps could have a direct impact on anadromous salmonids in project streams. Juvenile spring/summer chinook salmon are outmigrating at this time, and steelhead fry have been observed on the fringes of work areas (IDFG 1999). Temporary, short-term activity might cause instream turbidity, which could lead to short-term confusion among migrating juvenile spring/summer chinook salmon, and/or juvenile steelhead. (Juvenile bull trout would likely be well above the work areas.) These short-term impacts to juvenile anadromous salmonids are expected to be minor.

Weirs and traps are continuously manned by IDFG Program personnel during operation, and checked several times a day. Non-target fish caught in them would be passed along. Slight impacts could result in delayed spawning.

Direct Effects - Disease and Fish Size: IDFG Program managers believe that broodstock raised from parr are susceptible to instream pathogens, which they bring into the hatchery from collection sites. Bacterial Kidney Disease (BKD – *Renibacterium salmoninarum*) has caused the loss of approximately 36 percent of the Broodyear (BY) 1996 West Fork Yankee Fork sample, for instance. Whirling disease

(*Myxobolus cerebralis*) has been present in 38 percent of rearing groups from four IDFG Program years, and *Salmincola californiensis* has been found in parr collected from the Lemhi River. No viral disease agents have been detected in IDFG Program fish.

Collected parr tend to begin feeding later than hatched fry, affecting their size. Artificial rearing programs that collect eggs (e.g., Washington Department of Fish and Wildlife [WDFW] Spring Chinook Captive Broodstock Program) routinely produce 3- to 4-kg (6.6- to 8.8-pound [lb]) fish at age three; 5- to 7-kg (11- to 15.4-lb) fish at age four; and 8- to 10-kg (17.6- to 22-lb) adults at age five. IDFG Program results have not achieved comparable sizes. Small age-to-size ratios could affect the ability of IDFG Program broodstock to compete for mates.

On the other hand, theory has it that longer rearing duration intensifies some domestication effects. Parr obviously spend less time in-hatchery than eyed eggs, which could give them an advantage over rearing from eyed eggs. However, the relationship between rearing duration and domestication intensity is not known and, as in the case of age-to-size ratios, may lessen the intensity of some effects. These issues are monitored and evaluated by the IDFG Program.

Indirect Effects - Genetic Fitness/Variability: Collecting free-swimming parr for broodstock rather than stationary eyed eggs makes proper selection more difficult. Two problems have presented themselves in past IDFG Program years: Over-representation of one gender or another; and uncontrolled family representation. Unequal representation of family groups could potentially reduce genetic fitness/variability within the hatchery cohort, although this is probably not a severe problem. Unequal gender representation (observed 60+ percent female over-representation [IDFG 2000]) becomes a problem if and when broodstock are spawned in the hatchery, leading to less than ideal 1:1 spawn crossing.

High losses from parr-transmitted disease could reduce IDFG Program releases, which in turn could contribute to inbreeding depression. No other issues of genetic fitness/variability present themselves, other than those discussed in Section 4.2.2.4. All other impacts would be the same as well.

4.3.2. Alternative Adult Release Site

Big Springs Creek is considered a reasonable, and perhaps a preferable, alternative to the Proposed Action Bear Valley Creek Release site. This is because Big Springs Creek provides *relatively* (as opposed to absolutely) more reliable water quantity. Now that planned water withdrawal from Bear Valley Creek during adult release periods has stopped, water quantity does not appear to be a problem. In either case, direct and indirect effects on anadromous salmon from this alternative would be same as the Proposed Action *(see Sections 4.2.1 and 4.2.2).*

Big Springs Creek topography, ecology, and human and environmental resource profiles resemble those of the Lemhi River. Direct effects to any resources from adult releases

are expected to be the same as for the Proposed Action *(see Sections 4.2.3, 4.2.4, 4.2.5, and 4.2.6).*

4.3.3. No Action Alternative

If the No Action Alternative were selected, the current IDFG Program would most likely cease operation due to lack of funding. ESA-listed salmon would not be collected and would be allowed to spawn in the wild. Present target populations have an annual escapement of less than 20 fish. Since these numbers are below population critical thresholds, the risk of extirpation for these populations would be greater under the No Action Alternative. These impacts would reduce absolute numbers of the Snake River spring/summer chinook salmon ESU.

Within the populations themselves, genetic fitness/variability would remain at present levels until declining numbers began producing the effects of inbreeding. Critical genetic material may be lost to the ESU. This is uncertain, due to incomplete understanding of the overall genetic relationship between local populations and the ESU.

The cessation of the IDFG Program would reduce the opportunity for projects licensed by the Federal Energy Regulatory Commission to mitigate for lost salmonid production. Selection of the No Action Alternative could result in litigation by affected Northwest Indian tribes to ensure that the chinook salmon population is recovered and fishing rights are preserved.

Cessation of the IDFG Program would reduce current research on artificial rearing using captive broodstock techniques and protocols.

4.4. CUMULATIVE EFFECTS OF THE ALTERNATIVES

One objective of the IDFG Program is to increase spawning opportunities among spring/summer chinook salmon target populations by supplementing naturally reared adult returns with their hatchery-reared cohort. This objective has been met (IDFG 1999, 2000).

A second objective is to rear the hatchery cohort so that they mimic the natural cohort morphologically, physiologically, behaviorally, and genetically, which the IDFG Program hypothesizes would both maximize spawning success and produce fit fish. Since the hatchery-reared cohorts share gene pools with their natural-reared cohorts, and since they survive to sexual maturity in high proportions, they should genetically represent the populations. Whether or not hatchery rearing compromises spawning success is currently being monitored.

To the extent that the two objectives are met (and the underlying assumptions are correct), target populations could begin to recover. Increased offspring should increase genetic fitness/variability among the target populations. Increased natural escapement would add nutrients to streams, which would help reforge a critical link in ecosystem health.

Technology and data developed within the IDFG Program would be transferred to other programs, bringing similar benefits. In the long term, abundant anadromous species would produce economic benefits for local economies that depend on fish, fishing, tourism, and recreation for their income.

Should the IDFG Program hypotheses be incorrect, the numbers of eggs and parr removed from the natural environment would represent a net loss of broodstock. This would further endanger local populations on the brink of extirpation. This would hasten extirpation, without necessarily being its proximate cause. While healthy populations would seem on the face of it to contribute to the health of ESUs, determining the impact of the loss of these populations on the ESUs is uncertain.